SAFETY REQUIREMENTS

FOR

WELDING, CUTTING

AND

BRAZING

FOREWORD

This checklist has been compiled to **aid** those employers and employees in general industry and construction who seek to comply voluntarily with the Kentucky Occupational Safety and Health Program's standards for welding, cutting and brazing.

The questions which make up the checklist are based on 29 Code of Federal Regulations (CFR) Part 1910, Subpart Q, of the Kentucky Occupational Safety and Health Standards for General Industry, and 29 CFR Part 1926, Subpart J, of the Kentucky Occupational Safety and Health Standards for the Construction Industry. The standards were adopted by the Kentucky Occupational Safety and Health Standards Board under the authority of KRS Chapter 338.

The sections devoted to the most frequently cited standards have been included to assist in identifying standards violations at a workplace and should serve as a valuable tool for self-inspection.

The checklist is designed so that a negative answer to a question indicates an area of safety concern. However, it should be emphasized that the checklist is only a **guide**. Compliance with it does not necessarily assure full compliance with all Kentucky occupational safety and health standards.

As an additional voluntary compliance aid, the Division of Education and Training for Occupational Safety and Health offers on-site safety and health consultative surveys. Upon receipt of a written request, a Division staff member will visit a business or work site for the purpose of identifying violations of standards. Where possible, the consultant will offer suggestions on how these safety and health hazards may be corrected. Requests for this service, or information on other services offered by the Division, should be directed to one of the offices listed on the last page of this booklet.

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MOST FREQUENTLY CITED WELDING STANDARDS IN GENERAL INDUSTRY

1910.253(b)(4)(i) Oxygen cylinders shall not be stored near highly combustible material (especially oil and grease); near reserve stocks of carbide, acetylene, or other fuel gas cylinders; near any other substance likely to cause or accelerate fire; or in an acetylene generator compartment.

1910.253(b)(4)(iii) Oxygen cylinders in storage shall be separated from fuel-gas cylinders or combustible materials (especially oil or grease) a minimum of 20 feet or by a noncombustible barrier at least five (5) feet high having a fire-resistance rating of at least one-half hour.

1910.253(b)(2)(ii) Inside buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location at least 20 feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways. Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons. Cylinders shall not be kept in unventilated enclosures such as lockers or cupboards.

1910.253(b)(2)(iii) Empty cylinders shall have their valves closed.

1910.253(b)(2)(iv) Valve protection caps, where cylinders are designed to accept a cap, shall always be in place, hand-tight, except where cylinders are in use or connected for use.

1910.252(b)(2)(iii) Workers or other persons adjacent to an arc welding operation shall be protected by noncombustible or flame-proof screens or shields where the work permits. Assure that screens do not impede ventilation. Where the work does not permit, appropriate goggles shall be required. (See Kentucky Standards Interpretation No. 316-252(b)(2)(iii), Appendix this booklet.)

1910.254(d)(9)(iii) Cables with damaged insulation or exposed bare conductors shall be replaced. Joining lengths of work and electrode cables shall be done by the use of connecting means specifically intended for the purpose. The connecting means shall have insulation adequate for the service conditions.

WELDING, CUTTING AND BRAZING CHECKLIST FOR GENERAL INDUSTRY*

INSTALLATION AND OPERATION OF OXYGEN-FUEL GAS SYSTEMS FOR WELDING AND CUTTING-1910.253

Is acetylene generated, piped or utilized at a pressure of 15 p.s.i. absolute pressure or less? **1910.253(a)(2)**

Have personnel in charge of the oxygen or fuel gas supply equipment been instructed and judged competent before being left in charge? **.253(a)(4)**

Is the gas content of compressed gas cylinders marked with either the chemical or the trade name of the gas? **.253(b)(ii)**

Are cylinders stored away from radiators and other sources of heat? **.253(b)(2)(i)**

Are cylinders which are stored inside, kept stored inside a well-ventilated, dry location at least 20 feet from highly combustible material? **.253(b)(2)(ii)**

Are cylinders stored in assigned places away from elevators, stairs or gangways and where they will not be knocked over or damaged? **.253(b)(2)(ii)**

Are the valves of empty cylinders kept closed? **.253(b)(2)(iii)**

Are valve protection caps in place and hand-tight except when in use or connected for use? **.253(b)(2)(iv)**

Are fuel gas cylinders except those in use or attached for use, which are stored inside a building, limited to a total gas capacity of 2,000 cubic feet or 300 pounds of liquefied petroleum gas? **.253(b)(3)(i)**

Are acetylene cylinders stored valve end up? **.253(b)(3)(ii)**

If oxygen cylinders are stored in outside generator houses, are they separated from the generator or carbide storage rooms by a gastight, noncombustible partition having a fire-resistance rating of at least one hour? **.253(b)(4)(i)**

Are stored oxygen cylinders separated from fuel gas cylinders or combustible material by a minimum of 20 feet, or by a noncombustible barrier at least five feet high with a fire-resistance rating of at least one-half hour? **.253(b)(4)(iii)**

***Note: A negative answer to any question indicates an area of safety or health concern.**

Are cylinders, cylinder valves, couplings, regulators, hose and apparatus kept free from oily or greasy substances? **.253(b)(5)(i)**

Do you insure that cylinders are not dropped, struck or permitted to strike each other violently? **.253(b)(5)(ii)(b)**

Do you insure that valve-protection caps are not used for lifting cylinders from one vertical position to another? **.253(b)(5)(ii)(c)**

Do you insure that cylinders which do not have fixed hand wheels, have keys, handles or nonadjustable wrenches on the valve stems while the cylinders are in service? **.253(b)(5)(ii)(e)**

(NOTE: In multiple cylinder installations only one key or handle is required for each manifold.)

Are cylinder valves closed before moving cylinder and when work is finished? **.253(b)(5)(ii)(f)**

Are cylinders kept away from sparks, hot slag or flame produced by welding or cutting operations, or are fire-resistance shields provided? **.253(b)(5)(ii)(i)**

Are cylinders placed where they will not become part of an electric circuit? **.253(b)(5)(ii)(j)**

Do you insure that cylinders are not used as rollers or supports, and that only proper tools are used to open cylinder valves? **.253(b)(5)(ii)(k) and (q)**

Are fuel-gas cylinders placed valve end up while in use? **.253(b)(5)(iii)(a)**

Are cylinders with leaky valves or fittings taken outdoors and slowly emptied? **.253(b)(5)(iii)(f)**

Are warning signs posted which prohibit open flame or other sources of ignition near cylinders with leaking fuse plugs or other leaking safety devices, and are the cylinders tagged? **.253(b)(5)(iii)(g)**

MANIFOLD SYSTEMS

Do you insure that oxygen manifolds are not located in an acetylene generator room? **.253(c)(2)(ii)**

Do you insure that portable outlet headers are used indoors only for temporary service where conditions preclude a direct supply from outlets located on the service piping system? **.253(c)(4)(i)**

Is each outlet on the service piping which supplies a portable outlet header equipped with a readily accessible shutoff valve? **.253(c)(4)(ii)**

Are master shutoff valves for both oxygen and fuel-gas provided at the entry end of the portable outlet header? **.253(c)(4)(iv)**

Are portable outlet headers provided with frames to support the equipment securely in the correct operating position? **.253(c)(4)(viii)**

When acetylene cylinders are coupled in a manifold, are flash arresters installed between each cylinder and the coupler block? **.253(c)(5)(iii)**

In service piping systems, are distribution lines installed and maintained in a safe operating condition? **.253(d)(3)(i)**

Are emergency gas cocks or valves provided for all buildings? **.253(d)(3)(v)**

Is underground pipe and tubing and outdoor ferrous pipe and tubing protected against corrosion? **.253(d)(4)(i)**

GENERAL REQUIREMENTS

Is flash-back protection provided by an approved device that will prevent flame from passing into the fuel gas systems? **.253(e)(3)(ii)(c)(3)**

Are hoses showing defects repaired or replaced? **.253(e)(5)(v)**

Are pressure-reducing regulators used only for the gas and pressures for which they are intended? **.253(e)(6)(i)**

Is the repair of regulators performed by properly instructed, skilled mechanics? **.253(e)(6)(ii)**

Are gauges on oxygen regulators marked "USE NO OIL"? **.253(e)(6)(iii)**

Are union nuts and connections on regulators inspected before use to detect faulty seats? **.253(e)(6)(iv)**

ACETYLENE GENERATORS

Is ample space provided around the generator for operation and maintenance? **.253(f)(3)**

Are generators placed where water will not freeze, and is the use of sodium chloride to

prevent freezing prohibited? **.253(f)(4)(i)(b)**

Are portable generators located at a safe distance from the welding position? **.253(f)(5)(ii)(e)**

Are the walls, floors and roofs of outside generator houses constructed of noncombustible materials? **.253(f)(6)(i)(b)**

Are exit doors readily accessible? **.253(f)(6)(i)(d)**

Are generators installed inside buildings enclosed in a separate room? **.253(f)(6)(i)(g)**

Are the walls, partitions, floors and ceilings of inside generator rooms of noncombustible construction with a fire-resistance rating of at least one hour? **.253(f)(6)(i)(h)**

Are generator rooms or buildings well-ventilated with vents located at floor and ceiling levels? **.253(f)(6)(ii)**

Do generator rooms or buildings have natural light during daylight hours or artificial light restricted to electric lamps installed in a fixed position? **.253(f)(6)(iv)(a)**

Are operating instructions posted in a conspicuous place near the generator or available for ready reference? **.253(f)(7)(i)(a)**

Is the generator room electrically wired in accordance with **1910.307** (hazardous locations)?

Do you insure that the water-carbide residue mixture drained from the generator is not discharged into sewer pipes or stored in areas near open flames? **.253(f)(7)(i)(d)**

Do you insure that calcium carbide is kept in metal packages strong enough to prevent rupture? **.253(f)(7)(g)(1)(i)**

Are the packages marked "Calcium Carbide - Dangerous If Not Kept Dry"? **.253(f)(7)(g)(1)(ii)**

Do you insure that the calcium carbide stored indoors does not exceed 600 pounds and that the storage area is dry, waterproof, and well-ventilated? **.253(f)(7)(g)(2)(i)**

Are carbide containers that are stored outside periodically examined for conditions that could affect water or air tightness? **.253(f)(7)(g)(3)(ii)**

APPLICATION, INSTALLATION AND OPERATION OF ARC WELDING AND CUTTING EQUIPMENT - 1910.254

Have employees who are designated to operate arc welding equipment been properly instructed and qualified? **.254(a)(3)**

Are open circuit (No load) voltages of arc welding and cutting machines as low as possible, consistent with satisfactory welding? **.254(b)(3)**

When open circuit voltages must be higher, are means provided to prevent the operator from making accidental contact with the higher voltages? **.254(b)(3)(iii)**

Is control apparatus enclosed on all types of arc welding machines? **.254(b)(4)(ii)**

Are terminals for welding leads protected from accidental electrical contact by personnel or metal objects? **.254(b)(4)(iv)**

Do you insure that no connections for portable control devices, such as push buttons carried by the operator, are connected to an a.c. circuit of higher than 120 volts? **.254(b)(4)(v)**

Is the frame or case of the welding machine effectively grounded and the grounding checked? **.254(c)(2)(i) and (d)(3)**

Is a separate disconnecting switch or controller provided at or near each welding machine? **.254(c)(3)(i)**

Are electrode holders placed so that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks? **.254(d)(7)**

Has the operator been instructed to report any equipment defect or safety hazard to his supervisor, and is use of the equipment discontinued until repaired by qualified personnel? **.254(d)(9)(i)**

Are work and electrode lead cables frequently inspected for wear and damage, and are cables with damaged insulation or exposed bare conductors replaced? **.254(d)(9)(iii)**

INSTALLATION AND OPERATION OF RESISTANCE WELDING EQUIPMENT - 1910.255

Have personnel who are designated to operate resistance welding equipment been properly instructed and judged competent to operate such equipment? **.255(a)(3)**

Are all doors and access panels of all resistance welding machines and control panels kept locked and interlocked? **.255(b)(3)**

Has a shield guard of safety glass or suitable fire-resistant plastic been installed at the point of operation? **.255(b)(5)**

Are foot switches guarded to prevent accidental operation of the machine? **.255(b)(6)**

Are two or more safety emergency stop buttons provided on all special, multispot welding

machines, including 2-post and 4-post weld presses? **.255(b)(7)**

Are flash welding machines equipped with hoods to control flying flash? **.255(d)(1)**

Are periodic inspections of the machines made by qualified maintenance personnel, and are records of the inspections maintained? **.255(e)**

FIRE PREVENTION AND PROTECTION

Is suitable fire extinguishing equipment maintained in a state of readiness for instant use? **.252(a)(2)(ii)**

Are fire watches on duty whenever welding or cutting is performed in locations where a major fire might develop? **.252(a)(2)(iii)(a)**

Before cutting or welding is permitted, is the area inspected by the individual responsible for authorized cutting and welding operation? **.252(a)(2)(iv)**

Where practicable, are all combustibles relocated at least 35 feet from the work site? **.252(a)(2)(vii)**

Does management recognize its responsibility for the safe usage of cutting and welding equipment on its property? **.252(a)(2)(xiii)**

Do supervisors recognize their responsibilities in the safe management of welding and cutting operations as defined in **.252(a)(2)(xiv)(a)**?

PROTECTION OF PERSONNEL

Are welders or helpers who are working on platforms, scaffolds or runways protected against falling by railings, safety belts or lifelines? **.252(b)(1)(i)**

> (**NOTE:** Open sided floors and platforms four feet or more above floor or ground level require standard guardrails and intermediate rails. Toeboards are required when persons or moving machinery are likely to pass beneath, or there is equipment with which falling materials could create a hazard. Runways four feet above floor or ground require standard guardrails and intermediate rails on all open sides. Toeboards are required when tools or parts are used on the runway. Scaffolding more than 10 feet above ground or floor requires guardrails and toeboards on all open sides and ends; if this requirement cannot be met, safety belts attached to lifelines or lanyards shall be used.)

Is welding cable kept clear of passageways, ladders and stairways? **.252(b)(1)(ii)**

Are helmets, hand shields and goggles worn during all arc welding or cutting operations? **.252(b)(2)(i)(a)**

Has a hazard assessment been performed to determine if hazards are present or likely to be present? **.132(d)(1)**

Are employees who are exposed to the hazards created by welding, cutting or brazing operations protected by personal protective equipment required by **1910.132** and **1910.252(b)(3)**?

When welding or cutting is being performed in any confined space, are gas cylinders and welding machines left outside? **.252(b)(4)(iii)**

Before operations are started, is heavy, portable, wheel-mounted equipment securely blocked to prevent accidental movement? **.252(b)(4)(iii)**

Where a welder must enter a confined space through a manhole or other small opening, have means been provided for his quick removal in case of emergency? **.252(b)(4)(iv)**

HEALTH PROTECTION AND VENTILATION

Are ventilation or respiratory protective devices provided where necessary, and do they meet the equivalent requirement of **.252(c)(4)(i), (ii), (iii), (iv) and (v)**?

Are employees trained to render first aid, and is first aid equipment available at all times? **.252(c)(13)**

VENTILATION REQUIREMENTS FOR WELDING AND CUTTING - 1910 STANDARDS

METAL COMPOUND	REQUIREMENTS CONFINED SPACE	REQUIREMENTS INDOORS	REQUIREMENTS OUTDOORS
Fluorine Compound	Air replacement or airline respirator or self-contained breathing apparatus needed	Air sample tests to determine if exhaust hood, booth, airline respirator is required	Same as Indoors
Lead Zinc (Galvanized Metals)	Air replacement or airline respirator or self-contained breathing apparatus	Exhaust hood or booth	Combination particulate and vapor-and-gas removing type respirator if tests indicate need
Beryllium	Exhaust hood or booth and airline respirator if air sample tests indicate need	Exhaust hood or booth and airline respirator if air sample tests indicate need	Exhaust hood and airline respirator if air sample tests indicate need
Cadmium Mercury	Exhaust hood or booth or airline respirator if air sample tests indicate need	Exhaust hood or booth or airline respirator if air sample tests indicate need	Combination particulate and vapor-and-gas removing type respirator if tests indicate need

Airline or self-contained breathing apparatus required in confined area immediately hazardous to life.

Local exhaust hoods or booths must provide airflow of 100 linear feet per minute.

Mechanical ventilation at 2,000 cubic feet of air per minute per welder is required when welding or cutting on metals other than above described, or there is less than 10,000 cubic feet of space per welder or where the ceiling height is less than 16 feet or in confined spaces or where structural barriers (such as partitions or balconies) significantly obstruct cross ventilation. **1910.252(c)(2)(i)(a) through (c).**

NOTE: Mechanical ventilation is necessary when an exhaust hood or fixed booth provide for a rate of airflow sufficient to maintain a velocity away from the welder or not less than 100 linear feet per minute.

MOST FREQUENTLY CITED WELDING STANDARDS IN CONSTRUCTION INDUSTRY

1926.350(a)(9) Compressed gas cylinders shall be secured in an upright position at all times except, if necessary, for short periods of time while cylinders are actually being hoisted or carried.

1926.350(a)(1) Valve protection caps shall be in place and secured.

1926.350(h) Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use.

1926.351(b)(4) Cables in need of repair shall not be used. When a cable, other than the cable lead referred to in subparagraph (2) of this paragraph, becomes worn to the extent of exposing bare conductors, the portion thus exposed shall be protected by means of rubber and friction tape or other equivalent insulation. [Note: Subparagraph (2) states that cables with standard insulated connectors or with splices whole insulating quality is equal to that of the cable is permitted.]

WELDING AND CUTTING CHECKLIST FOR CONSTRUCTION*

TRANSPORTING, MOVING AND STORING COMPRESSED GAS CYLINDERS

Are valve protection caps in place and secured? **1926.350(a)(1)**

When transported by powered vehicles, are cylinders secured in a vertical position? **.350(a)(4)**

Are employees instructed not to use valve protection caps to lift cylinders from one vertical position to another? **.350(a)(5)**

Unless cylinders are firmly secured on a special carrier, have regulators been removed and are valve protection caps in place before moving? **.350(a)(6)**

Is a cylinder truck, chain, or other steadying device used to keep cylinders from being knocked over while in use? **.350(a)(7)**

Are cylinder valves closed when work is finished, when cylinders are empty or when cylinders are being moved? **.350(a)(8)**

Are cylinders secured in an upright position at all times except when hoisted or carried? **.350(a)(9)**

PLACING CYLINDERS

Are cylinders kept at a safe distance from welding operations, or are fire resistant shields provided? **.350(b)(1)**

Are cylinders placed where they cannot become part of an electrical circuit? **.350(b)(2)**

Do you insure that cylinders containing oxygen, acetylene or other fuel gas are not taken into confined spaces? **.350(b)(4)**

TREATMENT OF CYLINDERS

Have employees been instructed not to use cylinders, whether full or empty, as rollers or supports? **.350(c)(1)**

***NOTE: A negative answer to any question indicates an area of safety concern.**

USE OF FUEL GAS

Have employees been instructed in the safe use of fuel gas as outlined in **.350(d)(1) through (6)**?

FUEL GAS AND OXYGEN MANIFOLDS

Do fuel gas and oxygen manifolds bear the name of the substance they contain in letters at least one-inch high, either painted on the manifolds or on a sign permanently attached to them? **.350(e)(1)**

Are the manifolds placed in safe, well-ventilated and accessible locations and not within enclosed spaces? **.350(e)(2)**

HOSE

Do you insure that oxygen and fuel gas hoses are not interchangeable and that a single hose having more than one gas passage shall not be used? **.350(f)(1)**

Is all hose in use inspected at the beginning of each work shift and is defective hose removed from service? **.350(f)(3)**

Are hose couplings of the type that cannot be unlocked or disconnected without a rotary motion? **.350(f)(5)**

Are boxes which are used for the storage of gas hose ventilated? **.350(f)(6)**

TORCHES

Are torches in use inspected at the beginning of each shift for leaking shutoff valves, hose couplings and tip connections? **.350(g)(2)**

Do you insure that torches are lighted by friction lighters or other approved devices, and not by matches or from hot work? **.350(g)(3)**

REGULATORS AND GAUGES

Are oxygen and fuel gas regulators and their gauges in proper working order? **.350(h)**

OIL AND GREASE HAZARDS

Do you insure that cylinders, cylinder caps and valves, couplings, regulators, hose and apparatus are kept free from oil or greasy substances, and are not handled with oily hands or gloves? **.350(i)**

WELDING CABLES AND CONNECTORS

Do you use only cable which is free from repair or splices for a minimum of 10 feet from the cable end to which the electrode holder is connected? **.350(b)(2)**

> (**NOTE**: Cables with standard insulated connectors or with splices whose insulating quality is equal to that of the cable are permitted.)

Do you insure that cables in need of repair are not used? **.351(b)(4)**

OPERATING INSTRUCTIONS

Have employees been instructed in the safe means of arc welding and cutting as prescribed in **.351(d)(1) through (4)**?

Are arc welding and cutting operations shielded by noncombustible or flameproof screens? **.351(e)**

FIRE PREVENTION

Have employees been instructed that objects to be welded, cut or heated shall be moved to a designated location, or that movable fire hazards be taken to a safe place or otherwise protected? **.352(a)**

Is suitable fire extinguishing equipment, ready for instant use, available in the work area? **.352(d)**

VENTILATION AND PROTECTION

In confined spaces, when sufficient ventilation cannot be obtained without blocking the means of access, are employees protected by airline respirators? **.353(b)(2)**

Do welding, cutting and heating operations using toxic substances meet the requirements of **.353(a) and (c)**?

Are welders and other employees who are exposed to radiation suitably protected? **.353(d)(1)(iii)**

Are employees who are performing any type of welding, cutting or heating protected by suitable eye protective equipment? **.353(e)(2)**

PRESERVATIVE COATINGS

If the flammability of a preservative coating is unknown, is a test made by a competent person to determine its flammability? .**354(a)**

Are employees protected against toxic preservative coatings as prescribed in .**354(c)(1) and (2)**?

VENTILATION REQUIREMENTS FOR WELDING AND CUTTING - 1926 STANDARDS

METAL COMPOUND	REQUIREMENTS CONFINED SPACE	REQUIREMENTS ENCLOSED SPACE	REQUIREMENTS OPEN AIR
All metals	Mechanical ventilation or exhaust hood		
Zinc-bearing base or filler metals; lead base metals; cadmium-bearing filler materials; chromium-bearing metals		Mechanical ventilation or exhaust hood	Combination particulate and vapor-and-gas removing type respirator if tests indicate the need
Metals containing lead or coated with lead-bearing materials; cadmium-bearing or cadmium coated base metals; mercury-bearing metals		*Exhaust hood or airline respirator	Combination particulate and vapor-and-gas removing type respirator if tests indicate the need
Beryllium containing base or filler metals		*Exhaust hood and airline respirator	Airline respirator if tests indicate the need

*Freely movable hood placed by the welder as near as practicable to the work being welded, with a rate of airflow sufficient to maintain a velocity in the direction of the hood of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding.

--APPENDIX--
PROTECTION FROM ARC WELDING RAYS

NOTES